

## REAL-TIME MANAGEMENT OF DISSOLVED OXYGEN IN THE SAN JOAQUIN RIVER DEEP-WATER SHIP CHANNEL

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### RESEARCH OBJECTIVES

A decision support system (DSS) is under development within ESD as part of a CALFED-sponsored project to assist in management of episodes of low-dissolved-oxygen concentrations in the San Joaquin River (SJR) Deep-Water Ship Channel (DWSC). Biodegrading algae and organic sediments that settle in the DWSC remove oxygen from the water column. When dissolved oxygen concentrations dip below 5 mg/L, conditions adverse to the survival of juvenile salmon arise. ESD's science role in this project to date has been to develop an understanding of the relative algal contributions made by agriculture and managed seasonal wetlands, the fate of this algae in transit along the SJR, and its impact on dissolved oxygen in the DWSC.

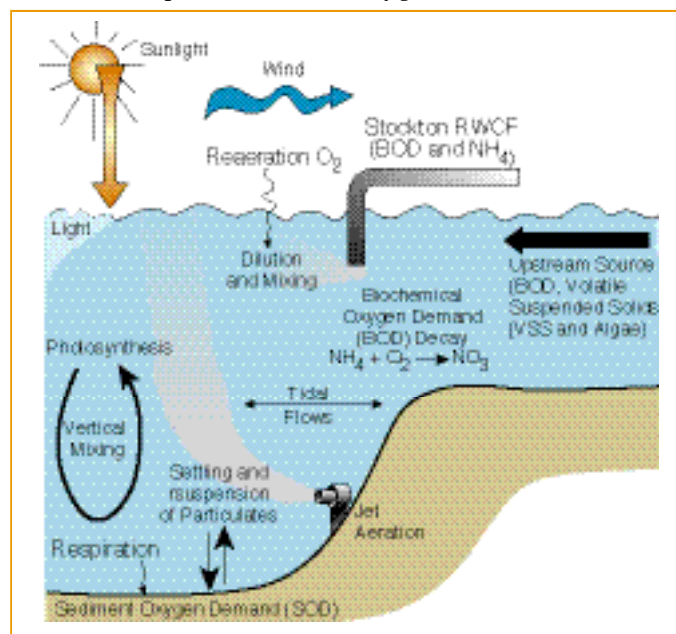


Figure 1. Conceptual model of factors contributing to low dissolved levels in the Stockton Deep-Water Ship Channel

### APPROACH

Flow and water quality were measured at three paired stations to obtain representative total biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (CBOD), and nitrogenous biochemical oxygen demand (NBOD) estimates for agricultural sources, privately owned wetlands, and public refuges. Total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS) and volatile suspended solids (VSS) were measured at each of the paired sites to further discriminate between the origin of the carbon that exerted the carbonaceous BOD. Ammonia, total phosphorous, and ortho-phosphate were also measured to determine the importance of these nutrients in potentially limiting the biodegradation rates of carbonaceous

material. Chlorophyll *a* concentrations provided an estimate of algae concentrations at each of the sites. Algae loads were compared for each upstream and downstream paired site to determine algal growth rates within each of these major drainage conveyances to the SJR. These findings were used to complete a conceptual model of upper-watershed algal loading to the DWSC.

### ACCOMPLISHMENTS

The major west-side drainage conveyances, Mud Slough and Salt Slough, were shown to contribute approximately 35% of the BOD entering the SJR. This suggests that algal growth in the SJR and east-side drainage contributions are more important than previously suspected in their contribution to DWSC dissolved-oxygen deficits. In the Mud Slough sub-basin, we were able to differentiate drainage coming from managed wetlands and agricultural land. Our research also confirmed the importance of irrigation diversions in affecting algal loading to the DWSC. Sharp reductions in agricultural diversions at both water districts increased algal loading to the DWSC during the months of September and October, and coincided with reduced dissolved-oxygen levels starting in mid-October, suggesting a possible causal mechanism.

### SIGNIFICANCE OF FINDINGS

This study has identified a possible opportunity to reduce the amount of oxygen-demanding materials entering the SJR from this watershed. The conceptual model developed and tested in this investigation will assist in calibration of a hydrodynamic water quality model of the SJR and its contributing watersheds. This model will form the basis of a DSS to forecast and help manage dissolved-oxygen levels in the DWSC.

### RELATED PUBLICATIONS

- Quinn, N.W.T. and A.T. Tulloch, San Joaquin River diversion data assimilation, drainage estimation and installation of diversion monitoring stations. Final Report. CALFED Bay-Delta Program, Sacramento, California, pp. 211, 2002.
- Stringfellow, W.T., and N.W.T. Quinn. 2002. Discriminating between west-side sources of nutrients and organic carbon contributing to algal growth and oxygen demand in the San Joaquin River. CALFED Bay-Delta Program, Sacramento, California, 2002; Berkeley Lab Report No. LBNL-51166, 2002.

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